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FORTY-FIVE YEARS' EXPERIENCE IN WATER WORKS[1]

By E. E. Davis

In September, 1872, I was employed in the capacity of walking boss in the water department of Richmond, Va., but as this was not exactly in my line, having served an apprenticeship at plumbing, gas and steam fitting and pipe work generally, I was given a force of men requiring the services of a general mechanic. In other words, my position was that of handy man around the store and shop. It was my purpose, after entering the service of the water department, to acquaint myself with hydraulics.

In the early days our service consisted of only one pumping station and one reservoir, about 44 miles of main varying in size from 1½ to 24 inches and an average daily pumpage of 2,400,000 gallons. The mains were of the character of those installed from 1831 to 1872, made of almost any kind of cast iron, some hard, some soft and some thin. During my forty-five years experience they have varied from the old to the newer style. Numerous breaks in the mains occurred from time to time and the most remarkable thing about them in the old days was we always had the worst in freezing weather.

All fire hydrants were of the compression type, with wooden or iron cases, and whenever the screws of the stems became worn, the lost motion caused the mains to burst when the hydrants were closed. The old wooden cases had to be made and put on in the best way possible. The hubs for the nozzles were not of the same size, and consequently it was necessary to cut holes in the wooden case with a compass saw to fit each one. Frequently when a main was repaired and the water turned on, the hydrant was left open for the air to get out, and if the men shut the hydrant off too fast, the pipe of course burst in another place.

The worst trouble we had was in the seventies with a compression type of fire hydrant. The firemen closed a hydrant at the bottom of a hill and the lost motion in the screw caused a water ram which resulted in the bursting of a 16 inch main, ⅝ inch thick, about 1000 feet away on the brow of a hill. We had to cut out this broken pipe and put in a new section. The leak was so large that a 50-foot roadway was nearly an inch deep in water for its entire width. This, of course, had to be fixed the same night the pipe burst. When we think of all the varieties of cast iron pipe, my trials and tribulations can be very readily understood.

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[1] Read before the annual convention at Richmond, May 10, 1917.

Among the worst troubles were those caused in repairing pipe smaller than 4 inches in diameter. On several occasions, after these old pipe were dug up, you could, on taking the rust off, stick a hole in them with a pocket knife, yet these same pipe, before removing the rust, withstood a static head of from 20 to 50 pounds per square inch. None of the pipe was tested before being laid and none of them was coated, therefore you can imagine our difficulties. All pipes used after 1872 were tested at a pressure of 300 pounds per square inch and our troubles eased up with the tested pipe but the old ones continued to break. Quite a lot of the old pipe is still in use, but a great deal of it has been taken out and replaced by larger mains. No city has had any more experience with pipe of antiquated casting than Richmond.

In olden times we had no pipe jointers. Thanks to old Tom Watkins for his pipe jointers. All joints were run after rolls of potter's clay had been made to fit each joint, which was all right when the joints were dry but lots of trouble occurred by the clay blowing off if any water happened to be in them.

In my time we also had the old-style piston pumps driven by breast water-wheels 16 feet in diameter. Owing to their location, whenever we had high water in the river, they were put out of commission, causing the reservoir at one time to be dry, when fire engines were used to pump water into the mains from the canal. This service was of very little help, as the water was wasted by parties leaving their fixtures open. One reservoir supplied the whole city until 1876, when a new reservoir, having a higher elevation, was put into service, resulting in the breaking of some of the old pipes and causing trouble for me and the other foremen when the water was turned on from the new reservoir.

My colleague in outdoor work was an old man who had been in service since 1856, and we had a time as there were, in those days, none of the up-to-date improvements we now have. There was no machinery available for calking or tapping, nor were there any couplings made for lead pipe. Whenever a coupling was needed, it had to be made to order. All connections for house supplies were the old-fashioned ferrules or tapping cocks driven into the main instead of being screwed in as is now done and in every case the water had to be shut off the main. You can no doubt appreciate my first experience in tapping, for these old drive ferrules had to be exact as to slightly bevelled holes and then driven sufficiently tight to hold. If hit too hard they would bounce out, in which case the drive end had to be filed to a smooth surface and carefully driven again. The last one of these ferrules was used in 1883, at which time I induced the superintendent to purchase a Hardesty tapping machine.

As I was just a little skeptical in using the machine, it was first put into operation under a bridge on a 4-inch pipe with a working pressure of 50 pounds. The next tap was on an 8-inch pipe under 85 pounds pressure, then on a 6-inch pipe under 30 pounds pressure. This machine was sent on thirty days trial, but performed the work so satisfactorily that the department purchased it.

Serious trouble was encountered when a hard pipe was found and we were sometimes required to dig to another pipe soft enough to tap. Then, again, the drill would go through the shell of the pipe and stall, leaving a hole of about $\frac{1}{2}$ inch, in which case the main pipe had to be shut off and a brass plug driven into the hole. All ends of cast iron pipes and specials 6 inches and under were plugged up with wooden plugs.

When a pipe split we had to cut out a piece and put in another section with a solid sleeve, for there were no split sleeves in those days. For all taps larger than 1 inch the main had to be cut and a special fitting put in. This was quite a job, as the water often leaked through the old valves and it was something of a problem to get rid of it. This we would often do by using a piece of hard twisted rope driven into the bell before the lead could be poured. We were not fortunate enough to have lead wool at that time. With the improvements since 1883 the water-works man has had a comparatively easy time, considering his troubles of the years before.

I shall never forget the first geared valve placed in service, used for the purpose of separating the high from the low service. On the day of its installation, I was called about 9 p.m. to the low reservoir, as it was about to run over, and remembering this particular valve, I realized that instead of turning the small pinion, only the main stem was used to shut down the valve.

I shall never forget my first experience in demonstrating the difference between flat or ordinance and meter rates. It occurred in connection with the bill for a livery stable for which the flat rate was $67 per annum. A meter was purchased and put on the service and instead of the bill being $67 per annum, the meter showed that it should have been $125 at 25 cents per one thousand gallons. My next experience was with a water motor at a restaurant, used only for driving fans during meal times. This motor was guaranteed not to use much water, but unfortunately for the proprietor of the restaurant, the bill became so large that he abandoned the motor and used clock fans, electrically driven fans at that time being unknown. A meter registered this service and the bills ranged from $10 to $25 per month.

More trouble came when the general installation of meters was first talked of, as all connections were straight pipes and ours a hilly city. During very cold weather the gauge at the office sometimes went down to almost nothing, occasioned by nearly every consumer leaving fixtures open and the water running to prevent frozen pipes. In 1895 the council appropriated $15,000 for the purchase of meters, which were installed on the lower parts of the service, and during the next winter the gauge showed 19 pounds instead of standing at nearly zero during freezing weather. The average pumpage per day in 1894 was 12,510,604 gallons through 85.09 miles of pipe, while in 1916 the average pumpage was 13,400,000 gallons with 80 per cent of the taps metered and with over 225 miles of mains.

My experience with pumps has been varied. In 1909 we abandoned all the old piston pumps at the old station and having only nine water-power pumps at the new station, which were not sufficient to keep up the supply, I took up the question of motor-driven centrifugal pumps, and after looking as far as possible into the efficiency of this kind of pump, finally decided to try them. We installed four such pumps of 4,000,000 gallons capacity each and found them to be very satisfactory.

My position from August, 1886, to January, 1908, was that of assistant superintendent and as such I was required to perform all the clerical work of the general office, which brought me into contact with all the water consumers to answer all sorts of questions and look into and report on all complaints. Having been one of the foremen before this time, I naturally had a deep interest in the outside working of the department, and was ready at all times to render any service in my power, not only to the superintendent but to any of the foremen or subordinates.

The work of constructing our settling basins was commenced in 1905 and completed in 1907. After my election as superintendent, in 1908, the flume conveying water from the basins to the pumps, 5000 feet away, was completed in the fall of 1909 and clear water pumped into the reservoirs and standpipe. My experience in clearing the water was limited, but as there was in the employ of the water department a very capable chemist, who experimented for over a year between the time of completing the basins and supplying water to the pumps, we had a very fine, clear and wholesome water.

During the past winter a 6-inch pipe, suspended under a big bridge and supplying 250 dwellings, froze throughout. This was the most remarkable thing I ever heard of, especially as it happened at 3 o'clock during the day, an hour when nearly everybody was using water for dinner. We had several other pipes exposed, none of which froze. I cannot understand why this should have frozen when water was running through it, unless due to exposure to the wind and a temperature of 4° above zero. It was my first experience with a pipe freezing with running water.